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Gary T. Rochelle

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EXAMINER

MCKENZIE, THOMAS B

ART UNIT

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4172

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/551,834	Applicant(s) ROCHELLE ET AL.	
	Examiner THOMAS BENNETT MCKENZIE	Art Unit 4172	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-42 is/are pending in the application.
4a) Of the above claim(s) 11-16 is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-10 and 17-42 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☒ Claim(s) 1-42 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date <u>07/19/2007 and 01/20/2009</u> . | 6) <input type="checkbox"/> Other: ____. |

DETAILED ACTION

Election/Restrictions

1. Restriction is required under 35 U.S.C. 121 and 372.

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1.

In accordance with 37 CFR 1.499, applicant is required, in reply to this action, to elect a single invention to which the claims must be restricted.

Group I, claim(s) 1-10 and 17-42 drawn to a method of removing carbon dioxide from a gaseous stream.

Group II, claim(s) 11-16, drawn to a composition comprising a piperazine derivative and a potassium salt.

The inventions listed as Groups I and II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: Both groups use a composition similar to that in **claim 11**. However, this subject matter does not appear to be novel in view of Sartori, USP 4,217,237. Sartori teaches a piperazine derivative (column 19, lines 10-18) having a concentration of at least 3.0 equivalents/Kg water (column 5, line 67-68), a potassium salt (column 5, lines 29-30) having a concentration of at least 1.0 equivalents/Kg water (column 5, line 35) and water ("aqueous", column 5, line 48), wherein the ratio of equivalents of alkali salt to equivalents of piperazine derivative is 0.3-3.0 (column 5, lines 35-36 and line 67). As such, there is no special technical feature among the groups that makes a contribution over the art.

2. This application contains claims directed to more than one species of the generic invention. These species are deemed to lack unity of invention because they are not so linked as to form a single general inventive concept under PCT Rule 13.1.

The species are as follows:

Group I: a method of removing carbon dioxide from a gaseous stream and

Group II: a composition comprising a piperazine derivative and a potassium salt.

3. During a telephone conversation with Gilbert Greene on 10/19/2009 a provisional election was made without traverse to prosecute the invention of Group I, **claims 1-10 and 17-42**. Affirmation of this election must be made by applicant in replying to this Office action. **Claims 11-16** are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

4. The examiner has required restriction between product and process claims. Where applicant elects claims directed to the product, and the product claims are subsequently found allowable, withdrawn process claims that depend from or otherwise require all the limitations of the allowable product claim will be considered for rejoinder. All claims directed to a nonelected process invention must require all the limitations of an allowable product claim for that process invention to be rejoined.

In the event of rejoinder, the requirement for restriction between the product claims and the rejoined process claims will be withdrawn, and the rejoined process claims will be fully examined for patentability in accordance with 37 CFR 1.104. Thus, to be allowable, the rejoined claims must meet all criteria for patentability including the requirements of 35 U.S.C. 101, 102, 103 and 112. Until all claims to the elected product are found allowable, an otherwise proper restriction requirement between product claims and process claims may be maintained. Withdrawn process claims that are not commensurate in scope with an allowable product claim will not be rejoined. See MPEP § 821.04(b). Additionally, in order to retain the right to rejoinder in accordance with the above policy, applicant is advised that the process claims should be amended during prosecution to require the limitations of the product claims. **Failure to do so may result**

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in a loss of the right to rejoinder. Further, note that the prohibition against double patenting rejections of 35 U.S.C. 121 does not apply where the restriction requirement is withdrawn by the examiner before the patent issues. See MPEP § 804.01.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. **Claims 1-4, 6-8, 17-22, 24, 36-39, and 41** are rejected under 35 U.S.C. 102(b) as being anticipated by Sartori et al, USP 4,217,237, hereafter referred to as Sartori.

Regarding **claim 1**, Sartori teaches a method of removing CO_2 from a gaseous stream comprising: contacting a gaseous stream with a solution (column 8, lines 56-65), the solution being formed by combining at least: a primary or secondary polyamine (column 8, lines 66-68; column 9, lines 1-6) of 2 to 20 weight percent (column 7, line 68) which reads on the claimed concentration: 3.0 equivalents/Kg water, an alkali salt ("potassium carbonate", column 7, line 64) having a concentration of 10 to 40 weight percent (column 7, line 65), which reads on the claimed range: at least 1.0 equivalents/Kg water and water ("aqueous" column 7, line 63); whereby contacting removes CO_2 (column 7, line 40) from the gaseous stream; and regenerating the solution (column 8, line 17).

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Regarding **claim 2**, Sartori teaches the polyamine is 2-tert.butylamino-methyl-1,4-dimethylpiperazine (column 19, line 15) or N,N'-di-isopropyl-ethylenediamine (column 9, line 15) which reads on the claimed group: piperazine, a piperazine derivative, ethylenediamine, dimethyl ethylenediamine, pyrazolidine, imidazolidine, 2-(2-pyrrolidyl)pyrrolidine, or 2-(2-imidazolidyl)imidazolidine.

Regarding **claim 3**, Sartori teaches the alkali salt is potassium carbonate (column 8, line 64), lithium carbonate (column 8, line 63-64), potassium bicarbonate (column 8, line 63) or sodium hydroxide (column 8, line 63) which reads on the claimed group: potassium carbonate, sodium carbonate, lithium carbonate, a bicarbonate salt, a bisulfide salt or a hydroxide salt.

Regarding **claim 4**, Sartori teaches the gaseous stream is contacted with the solution at a temperature of approximately 25-200°C (column 7, lines 3-4) which reads on the claimed range: 25-120°C.

Regarding **claim 6**, Sartori teaches the solution comprises an additive (column 19, line 64).

Regarding **claim 7**, Sartori teaches the polyamine concentration is between 2 and 20 weight percent (column 7, line 68; column 8, line 1) and the alkali salt concentration is between 10 and 40 weight percent, which reads on the claimed concentration of at least 2.3 m.

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Regarding **claim 8**, Sartori teaches the alkali salt concentration is between 10 and 40 weight percent (column 7, line 65) and the polyamine concentration is between 2 and 20 weight percent (column 7, line 68; column 8, line 1) which reads on the claimed ratio of 0.3-3.0.

Regarding **claim 17**, Sartori teaches a method of removing CO_2 from a gaseous stream comprising: contacting a gaseous stream with a solution (column 8, lines 56-65), the solution being formed by combining at least: a primary or secondary polyamine (column 8, lines 66-68; column 9, lines 1-6) of 2 to 20 weight percent (column 7, line 68) which reads on the claimed concentration: at least 5.1 equivalents/Kg water, an alkali salt ("potassium carbonate", column 7, line 64) having a concentration of 10 to 40 weight percent (column 7, line 65), which reads on the claimed range: at least 5.1 equivalents/Kg water and water ("aqueous" column 7, line 63); whereby contacting removes CO_2 (column 7, line 40) from the gaseous stream; and regenerating the solution (column 8, line 17).

Regarding **claim 18**, Sartori teaches the polyamine concentration is between 2 and 20 weight percent (column 7, line 68; column 8, line 1) and the alkali salt concentration is between 10 and 40 weight percent, which reads on the claimed concentration of at least 5.5 equivalents/Kg water.

Regarding **claim 19**, Sartori teaches the polyamine concentration is between 2 and 20 weight percent (column 7, line 68; column 8, line 1) and the alkali salt concentration is between 10 and 40 weight percent, which reads on the concentrations being equal.

Regarding **claim 20**, Sartori teaches the polyamine is 2-tert.butylamino-methyl-1,4-dimethylpiperazine (column 19, line 15) or N,N'-di-isopropyl-ethylenediamine (column 9, line 15) which reads on the claimed group: piperazine, a piperazine derivative, ethylenediamine, dimethyl ethylenediamine, pyrazolidine, imidazolidine, 2-(2-pyrrolidyl)pyrrolidine, or 2-(2-imidazolidyl)imidazolidine..

Regarding **claim 21**, Sartori teaches the alkali salt is potassium carbonate (column 8, line 64), lithium carbonate (column 8, line 63-64), potassium bicarbonate (column 8, line 63) or sodium hydroxide (column 8, line 63) which reads on the claimed group: potassium carbonate, sodium carbonate, lithium carbonate, a bicarbonate salt, a bisulfide salt or a hydroxide salt.

Regarding **claim 22**, Sartori teaches the gaseous stream is contacted with the solution at a temperature of approximately 25-200°C (column 7, lines 3-4) which reads on the claimed range: 25-120°C.

Regarding **claim 24**, Sartori teaches the solution comprises an additive (column 19, line 64).

Regarding **claim 36**, Sartori teaches a method of removing CO_2 from a gaseous stream comprising: contacting a gaseous stream with a solution (column 8, lines 56-65), the solution being formed by combining at least: a piperazine derivative (column 8, lines 66-68; column 9, lines 63-65; column 19, line 11) of 2 to 20 weight percent (column 7, line 68) which reads on the claimed concentration range: 3.0-10.0 equivalents/Kg water, an alkali salt ("potassium carbonate", column 7, line 64) having a

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concentration of 10 to 40 weight percent (column 7, line 65), which reads on the claimed range: 3.0-10.0 1.0 equivalents/Kg water and water ("aqueous" column 7, line 63); wherein the concentration of the piperazine derivative and the concentration of the alkali salt are approximately equal ("10 to 40 weight percent", column 7, line 65; "2 to 20 weight percent", column 7, line 68) whereby contacting removes CO_2 (column 7, line 40) from the gaseous stream; and regenerating the solution (column 8, line 17).

Regarding **claim 37**, Sartori teaches the piperazine derivative is 2-tert.butylamino-methyl-1,4-dimethylpiperazine, which reads on the claimed group: piperazine, aminoethylpiperazine, hydroxyethylpiperazine, 2-(3-pyrrolidyl)piperazine, 3-(3-piperidyl)piperidine, 3-(2-piperazinyl)piperidine, 3-(3-pyrrolidyl)piperidine, or 2-(2-piperazinyl)piperazine.

Regarding **claim 38**, Sartori teaches the alkali salt is potassium carbonate (column 8, line 64), lithium carbonate (column 8, line 63-64), potassium bicarbonate (column 8, line 63) or sodium hydroxide (column 8, line 63) which reads on the claimed group: potassium carbonate, sodium carbonate, lithium carbonate, a bicarbonate salt, a bisulfide salt or a hydroxide salt.

Regarding **claim 39**, Sartori teaches the gaseous stream is contacted with the solution at a temperature of approximately 25-200°C (column 7, lines 3-4) which reads on the claimed range: 25-120°C..

Regarding **claim 41**, Sartori teaches the solution comprises an additive (column 19, line 64).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

9. **Claims 5, 23, 31 and 40** are rejected under 35 U.S.C. 103(a) as being unpatentable over Sartori, USP 4,217,237 as applied to **claims 1, 17, 26 or 36** above, and further in view of "Absorption of carbon dioxide into aqueous piperazine: reaction kinetics, mass transfer and solubility", Sanjay Bishnoi and Gary Rochelle, Chemical Engineering Science, volume 55, issue 22, November 2000, pp. 5531-5543, hereafter referred to as Bishnoi (already of record).

Regarding **claims 5, 23, 31 and 40**, Sartori substantially teaches the limitations of **claims 1, 17, 26 or 36** as described above. Note that Sartori does not teach the rate constant for the reaction of carbon dioxide with the piperazine derivative (K_{PZ}) is at least $25 \text{ m}^3 / \text{mol} - \text{s}$ at 25°C. Note also that Sartori does not explicitly teach piperazine,

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although it does disclose that variations of the invention can be applied so long as they are within the customary practice in the art.

In an analogous art of absorbing carbon dioxide, Bishnoi substantially teaches the rate constant for the reaction of carbon dioxide with piperazine is 53,700

$m^3 / kmol - s$ at 25°C which reads on the claimed range of at least 25 $m^3 / mol - s$ at 25°C, for the benefit of absorbing carbon dioxide. It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the method described in Sartori with piperazine described in Bishnoi for the benefit of absorbing carbon dioxide.

10. **Claim 9** is rejected under 35 U.S.C. 103(a) as being unpatentable over Sartori in view of De Groote et al, USP 2,864,799, hereafter referred to as De Groote.

Regarding **claim 9**, Sartori substantially teaches the limitations of **claim 1**, as described above. However, Sartori does not teach the water wash system collects the polyamine from treated gaseous stream.

In an analogous art of collecting polyamines, De Groote teaches collecting polyamine using a water wash system (column 18, lines 25-27) for the benefit of collecting a polyamine. It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the water wash process described in De Groote with the method described Sartori for the benefit of collecting a polyamine.

11. **Claims 10, 25, 26-30, 32-35, and 42** are rejected under 35 U.S.C. 103(a) as being unpatentable over Sartori, USP 4,217,237.

Regarding **claims 10, 25, 35 and 42** Sartori substantially teaches the limitations of **claims 1, 17, 26 or 36** as described above. Note that Sartori does not explicitly teach

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the rate for the solvent-mediated removal of carbon dioxide from the gaseous stream is at least 1.5 times the rate for carbon dioxide removal in a method using an aqueous solution of 5.0-M monoethanolamine. However, Sartori teaches the absorption process is 20 to 60% greater than an aqueous scrubbing process wherein diethanolamine is the only amine activator utilized under similar conditions of gaseous feed composition, scrubbing solution composition, temperature and pressures (column 5, lines 13-20). This improvement reads on the claimed improvement of 1.5 times the rate for carbon dioxide removal. The scrubbing composition described uses up to 20 weight percent of amine activator (column 5, line 67), which would amount to around 2.5-M of diethanolamine or 5-M of monoethanolamine. Diethanolamine is chemically similar to monoethanolamine and it would have been obvious to one of ordinary skill in the art for the method described in Sartori to have a 20 to 60% improvement over an aqueous solution using monoethanolamine as the amine activator.

Regarding **claim 26**, Sartori substantially teaches a method of removing CO_2 from a gaseous stream comprising: contacting a gaseous stream with a solution (column 8, lines 56-65), the solution being formed by combining at least: a primary or secondary polyamine (column 8, lines 66-68; column 9, lines 1-6) of 2 to 20 weight percent (column 7, line 68) which reads on the claimed concentration: 3.0 equivalents/Kg water, an alkali salt ("potassium carbonate", column 7, line 64) having a concentration of 10 to 40 weight percent (column 7, line 65), which reads on the claimed range: at least 1.0 equivalents/Kg water and water ("aqueous" column 7, line 63);

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whereby contacting removes CO_2 (column 7, line 40) from the gaseous stream; and regenerating the solution (column 8, line 17).

Note that Sartori does not teach the solution contains less than 1% of a monohydric or polyhydric alcohol. However Sartori teaches 2 to about 20% by weight of at least one sterically hindered amine (column 4, line 64) and lists several monohydric or polyhydric alcohols as these sterically hindered amines (columns 9-28). In re Aller where the general conditions a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.

Regarding **claim 27**, Sartori does not explicitly teach that no alcohol is added to the solution. However, it does provide several polyamines used in the process that are not alcohols. It would have been obvious to one of ordinary skill in the art at the time of the invention to use only those polyamines with no hydroxyl group and to add no alcohol to the solution.

Regarding **claim 28**, Sartori substantially teaches the polyamine is 2-tert.butylamino-methyl-1,4-dimethylpiperazine (column 19, line 15) or N,N'-di-isopropylethylenediamine (column 9, line 15) which reads on the claimed group: piperazine, a piperazine derivative, ethylenediamine, dimethyl ethylenediamine, pyrazolidine, imidazolidine, 2-(2-pyrrolidyl)pyrrolidine, or 2-(2-imidazolidyl)imidazolidine..

Regarding **claim 29**, Sartori substantially teaches the alkali salt is potassium carbonate (column 8, line 64), lithium carbonate (column 8, line 63-64), potassium bicarbonate (column 8, line 63) or sodium hydroxide (column 8, line 63) which reads on

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the claimed group: potassium carbonate, sodium carbonate, lithium carbonate, a bicarbonate salt, a bisulfide salt or a hydroxide salt.

Regarding **claim 30**, Sartori substantially teaches the gaseous stream is contacted with the solution at a temperature of approximately 25-200°C (column 7, lines 3-4) which reads on the claimed range: 25-120°C.

Regarding **claim 32**, Sartori substantially teaches the solution comprises an additive (column 19, line 64).

Regarding **claim 33**, Sartori teaches the polyamine concentration is between 2 and 20 weight percent (column 7, line 68; column 8, line 1) and the alkali salt concentration is between 10 and 40 weight percent, which reads on the claimed concentration of at least 2.3 m

Regarding **claim 34**, Sartori substantially teaches the alkali salt concentration is between 10 and 40 weight percent and the polyamine concentration is between 2 and 20 weight percent (column 7, line 68; column 8, line 1), which reads on the claimed ratio of 0.3-3.0.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to THOMAS BENNETT MCKENZIE whose telephone number is (571) 270-5327. The examiner can normally be reached on Monday-Thursday 7:30AM-5:00PM Alt. Friday 7:30AM-4:00PM EST..

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, ANGELA ORTIZ can be reached on (571) 272-1206. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

TBM

/Angela Ortiz/

Supervisory Patent Examiner, Art Unit 4172